COTTAGER'S SELF HELP PROGRAM

ENRICHMENT STATUS OF SEVENTY-ONE LAKES IN THE SOUTHEASTERN REGION OF ONTARIO

1979

Ministry of the Environment
Ontario

GENERAL KWTC
cottage pollution

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Technical Support Section

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ABSTRACT

This report presents Secchi disc and chlorophyll data collected from 88 lakes in the Southeastern Region of Ontario during the summer of 1979. An attempt is made to define the enrichment status of 71 of these lakes for which 6 or more sets of measurements are available. The data were collected through the assistance of volunteers who took Secchi disc readings and water samples from lakes on which they are situated. The program has been active since 1971. A meaningful data base is now being accumulated for a number of lakes. It is apparent that although algae growth is directly related to nutrient inputs, it also varies with climatic conditions and varies in intensity in different lakes at different seasons of the year. Theses variations can only be understood from study of the long-term data now being accumulated. The results provide the Ministry of Environment with an excellent means of monitoring water quality in our recreational lakes and of investigating any cases of deteriorating water quality and suggesting possible preventive action.

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The author of this report, D.L. Galloway, gratefully acknowledges the assistance of the numerous cottagers, lake-side residents and staff of the Ministries of Natural Resources and Environment who volunteered their time to undertake the Secchi disc visibility readings and water sampling for the 1979 Self Help Program.

INTRODUCTION

Ontario has some 250,000 inland lakes and borders on four of five Great Lakes. A general increase in leisure time, growing affluence, and the accessibility of lakes in vacation areas of Southern Ontario to urban centres of population has resulted in the extensive development of our lakes with summer cottages. In addition, many thousands of tourists and vacationers spend weekends and holidays at lakeside resorts and campgrounds.

Increased development and use of lakes sometimes results in changes within a lake itself. These changes are often marked with excess weed growths, increasing turbidity, a decline in water clarity, the disappearance of certain species of sports fish, and disminished recreational use. It has become evident that not all lakes are equally capable of supporting an increasing number of people and their recreational activities. There is clearly a need to manage future waterfront development to ensure that we make the best use of the recreational potential of our lakes, not only for this generation, but also for those to follow.

The first step in determining the capacity of a lake for development is to determine its existing water quality and to gain an understanding of any changes that may occur. Since 1970, the Ministry of the Environment has been engaged in a continuing recreational lake survey program to collect and assess water quality data from lakes in the province. Water samples are collected and tested for a wide range of parameters including water clarity, temperature, dissolved oxygen, alkalinity,

acidity and concentrations of plant nutrients. Over 200 such lake surveys have been completed in the Southeastern Region of Ontario.

The Ministry of the Environment does not have the fiscal or logistical resources to conduct intensive surveys on all lakes in the province on a routine basis, nor are such surveys necessary to monitor recreational water quality of our lakes.

Water clarity is one of the most important aspects of a lake from recreational and aesthetic points of view. Water clarity is affected by the abundance of phytoplankton (microscopic algae suspended in the water of a lake). The proliferation of phytoplankton in lakes causes their waters to become progressively more turbid and water clarity diminishes as a result. The growth of phytoplankton is mainly dependent on the plant nutrients present to fertilize it. The key nutrient is phosphorus. Phosphorus is present in a lake through natural processes, but its level can be influenced by man's activities.

The Ministry of the Environment introduced a relatively simple but effective Self Help Program in 1971 which involves the assistance of cottage associations and individual lake residents to measure the clarity of their lake at regular intervals and to collect water samples for testing by the Ministry of the Environment for their phytoplankton content.

This report presents the data collected from 88 lakes enrolled in a Self Help Program in the Southeastern Region of Ontario during 1979 (Table 1). It comments on the findings relative to the degree of aquatic

productivity or trophic (nutrient) status of 71 lakes (74 basins) with 6 or more sets of measurements from a program of at least 3 months duration. The Southeastern Region includes Hastings and Renfrew Counties and extends eastward to the Quebec border. The Ministry of the Environment publication Cottage Country provides an explanation of water quality problems in recreational lakes. Copies are available to the public without charge from any Ministry of the Environment office.

Table I: Lakes in the Southeastern Region of Ontario that were samples in 1979 as part of the Cottager's Self-Help Program.

LAKE		COUNTY(S)	TOWNSHIP(S)
1.	Albion	Hastings	Faraday
2.	Ashby	Lennox & Addington	Ashby
3.	Baptiste	Hastings	Herschel
4.	Bass	Leeds	Rear of Leeds & Lansdowne
5.	Bay	Hastings	Faraday
6.	Bellamy	Leeds	Bastard, Kitley
7.	Bennett	Lanark	Bathurst
8.	Big Clear	Frontenac	Bedford
9.	Big Gull (Clarendon)	Frontenac	Clarendon, Barrie
10.	Big Rideau	Lanark, Leeds	North Burgess, North Elmsley, South Burgess, South Elmsley
11.	Black	Frontenac	Olden
12.	Bobs	Frontenac	Bedford
13.	Boulter	Hastings	McClure
14.	Brule (Wensley)	Frontenac	Miller
15.	Buck - North Bay	Frontenac	Loughborough, Bedford, Storrington
16.	Buckshot	Frontenac	Miller
17.	Camp (Little Mackie)	Frontenac	Miller
18.	Canoe	Frontenac	Bedford
19.	Carson	Renfrew	Jones, Sherwood
20.	Charleston	Leeds	Rear of Yonge and Escott & Lansdowne
21.	Chippego	Frontenac	Hinchinbrooke

LAKE		COUNTY(S)	TOWNSHIP(S)
22.	Christie	Lanark	Sherbrooke, Bathurst
23.	Clear	Renfrew	Sebastopol
24.	Collins Bay	Frontenac	Kingston
25.	Colton	Renfrew	Admaston
26.	Constant (Constan)	Renfrew	Grattan
27.	Cranberry	Frontenac	Storrington
28.	Cronk	Frontenac	Loughborough
29.	Crosby	Leeds	North Crosby
30.	Crowe	Hasting, Peterborough	Marmora, Belmont
31.	Dalhousie	Lanark	Dalhousie
32.	Desert	Frontenac	Loughborough
33.	Diamond	Hastings	Herschel
34.	Dog	Frontenac	Storrington
35.	Dore	Renfrew	Wilberforce
36.	Eagle	Frontenac	Hinchinbrooke
37.	Gananoque	Leeds	Rear of Leeds & Lansdowne Front of Leeds & Lansdowne
38.	Garskeys (Ellens)	Renfrew	Brougham
39.	Glanmire	Hastings	Tudor
40.	Golden	Renfrew	North Algoma
41.	Gorman	Renfrew	Brudenell
42.	Graphite	Hastings	Monteagle
43.	Green	Renfrew	Brougham
44.	Grippen	Leeds	Rear of Leeds
45.	Hambly (Silver)	Frontenac	Portland
46.	Hay Bay	Lennox & Addington	Fredericksburgh

LAKE	COUNTY(S)	TOWNSHIP(S)
47. Howes	Frontenac	Portland
48. Hurds	Renfrew	Bagot
49. Joeperry	Lennox & Addington	Abinger
50. Kaminiskeg	Hastings, Renfrew	Bangor, Sherwood
51. Kennebec	Frontenac	Kennebec
52. Limerick	Hastings	Limerick
53. Little Silver	Lanark	South Sherbrooke
54. Loughborough	Frontenac	Storrington
55. Mackie	Frontenac	Miller
56. Mazinaw	Lennox & Addington	Abinger
57. Mink	Renfrew	Wilberforce
58. Mississippi	Lanark	Drummond, Beckwith, Ramsay
59. Moira	Hastings	Huntington
60. Mosque	Frontenac	Miller, Clarendon
61. Muskrat	Renfrew	Westmeath
62. Norway	Renfrew	Bagot
63. Olmstead	Renfrew	Ross
64. Opinicon	Frontenac, Leeds	Bedford, Storrington, South Crosby
65. Otter	Leeds	Bastard, South Elmsley
66. Otty	Lanark	North Burgess, North Elmsley
67. Palmerston	Frontenac	Palmerston, South Canonto
68. Pike	Lanark	North Burgess
69. Potspoon	Frontenac	Bedford
70. Red Horse	Leeds	Rear of Leeds & Lansdowne

LAKE		COUNTY(S)	TOWNSHIP(S)
71.	Robertson	Lanark	Lavant
72.	Round	Renfrew	Hagarty, Richards
73.	St. Peter	Hastings	McClure
74.	Salmon Trout	Hastings	Monteagle
75.	Sharbot	Frontenac	Olden
76.	Silver	Frontenac, Lanark	Oso, South Sherbrooke
77.	Spectacles	Renfrew	Dickens, Nipissing, Jones
78.	Steenburg	Hastings	Limerick, Tudor
79.	Sydenham	Frontenac	Loughborough
80.	Temperance	Leeds	Reer of Yonge & Escott
81.	Thirty Island	Frontenac	Bedford
82.	Trout (Stubbs)	Renfrew	Sherwood, Jones
83.	Troy	Leeds	South Crosby
84.	Verona (Rock)	Frontenac	Portland
85.	Weslemkoon	Lennox & Addington	Ashby
86.	White	Lanark, Renfrew	Darling, Bagot & McNab
87.	White	Frontenac	Bedford
88.	Whitefish	Leeds	South Crosby, Rear of Leeds & Lansdowne

METHODS

Volunteers who contacted the Ministry of Environment to assist in a Self Help Program were provided with a Secchi disc, a water sampling device, bottles, detailed sampling instructions and return shipping material. The Secchi disc is a steel plate 20 cms. (8 inches) in diameter painted in opposing black and white quadrants (Fig. 1). It is lowered into the lake on a line marked in depth intervals until the quadrants disappear from view, then slowly raised until they can just be seen again. The average of those two depths is termed the Secchi disc visibility depth and is a measure of the water clarity of the lake. Water clarity measurements were made at weekly or bi-weekly intervals over as much as possible of the ice-free season depending on the samplers' availability at the lakes.

The depth at which algae cease to occur in a lake owing to insufficient light to support their growth is approximated by twice the Secchi disc depth visibility. Phytoplankton samples were collected at the same time as water clarity measurements by lowering a narrow-mouthed 1 litre bottle in a weighted sampler through the zone of phytoplankton growth as determined by doubling the Secchi disc depth measurement. The speed of lowering and raising the sampler was regulated by trial and error repitition so that the bottle was just filled as it ascended to the surface. In this manner, a composite water sample equally representative of all depths of the measured water column was collected. The phytoplankton samples were preserved immediately after collection with 0.5 ml (5 drops) of one-half percent magnesium carbonate suspension to minimize degradation of chlorophyll pigment, and were delivered as soon as possible, usually within a day or two, to the Ministry of the Environment laboratory by a C.O.D. shipment.

One way to measure the phytoplankton content of a sample of water is to place an aliquot under a microscope and count the individual algal cells present. This is a fairly time consuming and tedious procedure.

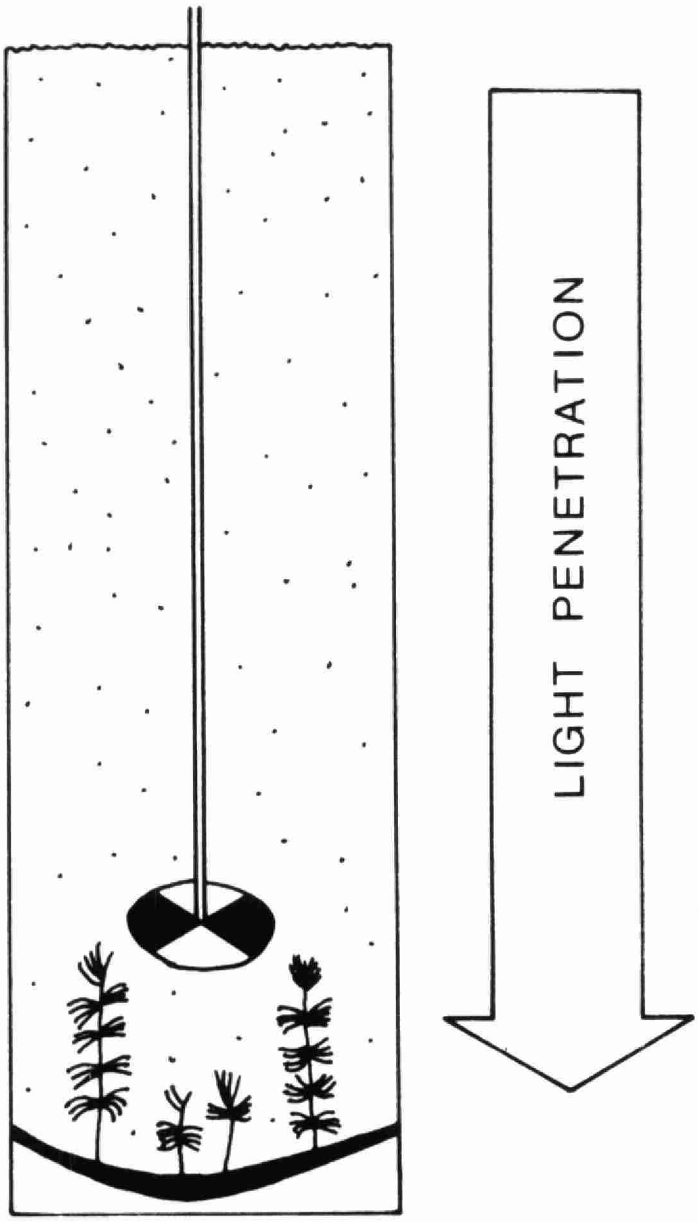

Figure 1: Diagram illustrating the use of a Secchi disc to measure water clarity. Greater visibility characterizes clear lakes having low algal densities (left panel) than productive lakes which contain high algal levels and have low light penetration (right panel).

Therefore, a more commonly used measure of the amount of algae per unit volume of water is to separate the algae from the water sample onto an extremely fine pored filter and to chemically measure the amount of green pigment called chlorophyll a on the filter. Chlorophyll a is a component of all green plants. The quantity of chlorophyll in a water sample provides an estimate of the amount of phytoplankton in a lake at the time of sampling.

Phytoplankton samples were filtered using a 1.2 micron filter paper, the residue extracted with 90% acetone and the chlorophyll concentration determined spectrophotometrically according to standard techniques of the Ministry of Environment Laboratory Services Branch.

DISCUSSION OF RESULTS

Eighty-eight (88) lakes were enrolled in the 1979 program (Table 1). The enrollment consisted of 22 "new" lakes and 66 lakes that were included in the program in 1978.

The mean Secchi disc visibility depths and chlorophyll concentrations for 71 lakes (74 basins) with six or more pairs of measurements each from sampling programs of at least three months duration are summarized in Table 2. Individual results for all 88 lakes are presented in Table 4.

Some lakes are represented by more than one sampling station. This is necessary for lakes divided into two or more distinct basins (Loughborough, Moira, Sharbot) or that are comprised of a number of bays (Bob's, Mosque) which may act independently from a water quality point of view, and is desirable for large irregularly shaped lakes (Baptiste, Charleston, Desert, etc.) where regional differences in water clarity and phytoplankton levels might be expected to occur.

Seasonal variability in productivity is a marked feature of a number of lakes. Albion, Green, Mackie, Palmerston, for example, appear to attain their highest chlorophyll concentrations during mid summer while a number of other lakes including Christie, Garskeys, Glanmire, Howes, Little Silver, Moira, Opinicon and Salmon Trout experienced their maximum chlorophyll concentrations and poorest water clarity during late summer or early fall. As a result of this seasonal variation, the months during which a lake is sampled may influence the results. For example,

Table 2: Means for Secchi disc visibility depths (metres) and chlorophyll concentrations (micrograms per litre) for 71 lakes (74 basins) with 6 or more sets of data in the Southeastern Region of Ontario duing 1979. Number of measurements used in the derivation of the means is also presented. When a different number of Secchi and chlorophyll measurements were available, the number of Secchi measurements is presented first.

LAKE		Seechi Mean (metre)	Chloro a Mean (ug/l)	Number of Samples
1.	Albion	3.6	3.6	12
2.	Ashby	5.6	1.4	13
3.	Baptiste	4.5	1.8	19
4.	Bass	4.7	1.7	8, 12
8.	Big Clear	9.2	1.3	7, 9
10.	Big Rideau	4.4	2.3	10
11.	Black	5.2	1.5	6
12.	Bobs -Buck Bay	3.6	3.3	7
14.	Brule (Wensley)	6.5	1.2	12
15.	Buck - North Bay	3.5	4.0	19
17.	Camp (Little Mackie)	9.9	1.3	8
18.	Canoe	6.0	1.4	13
19.	Carson	5.7	1.8	14
20.	Charleston	3.9	2.5	51, 47
21.	Chippego	3.1	4.0	21, 20
22.	Christie	4.4	4.1	7, 6
23.	Clear	4.1	1.7	26
24.	Collins Bay	3.0	6.4	6
25.	Colton	5.7	1.1	6
26.	Constant (Constan)	4.0	1.4	13
27.	Cranberry	2.1	9.2	15
28.	Cronk	5.1	1.3	9
30.	Crowe	2.4	3.2	10
31.	Dalhousie	3.4	1.9	15
32.	Desert	4.5	2.0	28, 27
33.	Diamond	4.9	1.3	6, 5
34.	Dog	1.9	9.4	9
35.	Dore	4.7	2.2	6
36.	Eagle	4.7	2.2	35
37.	Gananoque	3.2	3.1	12
38.	Garskeys (Ellens)	3.4	3.0	14
39.	Glanmire	3.6	3.4	11

	LAKE	Secchi	Chloro. a	No. of Samples
40.	Golden	4.0	1.7	15, 14
43.	Green	7.9	1.6	11
44.	Grippen	2.9	2.5	8, 11
46.	Hay Bay	1.2	16.6	24, 23
47.	Howes	1.9	7.4	14
48.	Hurds	4.4	2.9	10
50.	Kamaniskeg	4.5	1.7	34, 32
51.	Kennebec	3.2	2.4	14
52.	Limerick	4.4	1.4	8, 7
53.	Little Silver	4.0	4.6	7
54.	Loughborough			
	a) east basin	3.3	3.6	14, 13
	b) west basin	4.0	2.0	27, 14
55.	Mackie	6.7	4.6	13
56.	Mazinaw	5.2	1.4	15
57.	Mink	4.1	1.4	7
59.	Moira			
	a) west basin	1.9	6.5	8
60.	Mosque			
	a) main basin	4.6	3.2	6
	b) north basin	5.5	1.4	18
61.	Muskrat	2.4	7.1	22
62.	Norway	4.7	1.7	11
63.	Olmstead	6.3	1.2	7
64.	Opinicon	3.3	3.7	20, 19
65.	Otter	3.1	2.3	16
66.	Otty	4.4	2.1	22
67.	Palmerston	8.8	1.6	15
68.	Pike	3.7	4.0	9
69.	Potspoon	3.6	2.9	15
70.	Red Horse	3.4	4.4	18
72.	Round	4.5	2.0	11
73.	St. Peter	3.5	2.0	6
74.	Salmon Trout	3.2	7.4	13, 12
75.	Sharbot			
	a) east basin	3.1	2.0	36
	b) west basin	4.4	1.9	6
76.	Silver	4.1	2.0	38
78.	Steenburg	4.5	2.1	9
79.	Sydenham	3.6	3.0	11, 10
80.	Temperance	2.6	3.1	7
81.	Thirty Island	4.6	1.7	9, 8
83.	Troy	2.0	8.0	19, 18
84.	Verona (Rock)	2.3	6.5	7
86.	White	3.0	3.0	25
88.	Whitefish	3.0	2.6	14
	Overall mean	4.19	3.20	
	Median	4.0	2.2	
	Range	1.2 - 9.9	1.1 - 16.6	

mean chlorophyll concentration and Secchi disc depths for Glanmire Lake from June 3rd to August 11th differ quite considerably from the means for the period August 11th to September 30th.

Glanmire Lake	Secchi (m)	Chlorophyll a (ug/l)
June 3 - August 11	4.2	2.4
August 11 - Sept. 30	2.3	4.2
Overall mean	3.6	3.4

Obviously, the most realistic appraisal of water quality at Glanmire Lake is based on the overall mean values derived from the entire set of sampling results which encompass the recreational season from June 3rd to September 30th. (Glanmire Lake exhibited the same tendency for late season phytoplankton productivity in 1978, 1977 and 1976).

It should be realized that, in some cases, lakes were sampled during the summer months only and, therefore, the presence or absence of increased phytoplankton levels in the spring or fall or other seasonal trends cannot be confirmed. Some discretion should be exercised in comparing lakes since the commencement, regularity and duration of sampling differs from one lake to the next and may correspondingly affect their mean Secchi and chlorophyll values.

No attempt at all should be made to define the water quality of lakes with less than six sets of measurements or fewer than three months of sampling. Lakes that do not satisfy these sampling criteria are omitted from Tables 2 and 3 and Figure 2 and are not discussed further in the

report. Ideally, sampling should be conducted weekly or bi-weekly on a consecutive monthly basis during most of the ice-free season.

Table 4 presents the standard deviation of chlorophyll concentrations and Secchi disc visibility depths for each lake. The standard deviation is a statistic that is a measure of the variability or fluctuation in individual values comprising a set of measurements. It therefore provides an indication of how well the mean represents the data. The standard deviation is large if individual measurements vary greatly and small for a set of values that are clustered tightly about their mean. For example, in Opinicon Lake, chlorophyll concentrations vary from 1.4 ug/l to 12.4 ug/l (mean value 3.7 ug/l). The standard deviation of 2.48 ug/l reflects this variability. In the east basin of Loughborough, chlorophyll concentrations range between 2.0 and 5.7 ug/l (mean 3.6 ug/l) for approximately the same sampling period. The standard deviation of chlorophyll concentrations for the east basin of Loughborough Lake is thus only 1.04 ug/l. Lakes with chlorophyll and Secchi values that fluctuate widely within a season will probably have mean values that vary considerably from year to year. The standard deviation can be used to determine if the differences in yearly means for these lakes is statistically significant or not.

The overall average of mean Secchi disc visibility depths for the 74 water bodies included in Table 2 was 4.2 metres, unchanged from the average for a similar number of water bodies included in the 1978 Self Help Program. The most transparent lakes were Camp (9.9 metres), Big Clear (9.2 metres), Palmerston (8.8 metres), Green (7.9 metres),

Mackie (6.7 metres) and Brule Lake (6.5 metres). The exceptional clarity of lakes with mean Secchi disc depths greater than 5 metres is attributable to the sparseness of the phytoplankton population in their waters. Most of the above lakes have chlorophyll concentrations less than 2 ug/l. Secchi disc depths between 3 and 5 metres characterize most of our recreational lakes, 48 of these are included in the 1979 program, and are indicative of a moderate amount of phytoplankton productivity. Lakes with Secchi disc readings less than 3 metres as a seasonal average probably experience a reduction in their water clarity due in part to high levels of phytoplankton. The least transparent waters were found in Hay Bay (1.2 metres), Moira Lake (1.9 metres), Dog Lake (1.9 metres), Howes Lake (1.9 metres), and Troy Lake (2.0 metres). All of these lakes have chlorophyll concentrations greater than 5 ug/l. These basins are situated in Paleozoic bedrock of sedimentary origin and are surrounded by rich agricultural land that undoubtedly contributes substantially to their productivity.

In general chlorophyll concentrations were low. The average of the seasonal mean chlorophyll concentrations for lakes sampled during 1979 was 3.2 ug/l, an increase of 14% from the overall mean of 2.8 ug/l for the 1978 program. An increase of this magnitude does not necessarily indicate an increase in the algal content of our lakes. The difference may arise as a result of sampling of lakes at times of greater seasonal productivity than in 1978, or it may simply be a reflection of the cooler and somewhat less sunny weather experienced during the past summer. Algal cells can increase their chlorophyll content to compensate for less favourable growing conditions.

The lowest chlorophyll concentrations were found in Colton (1.1 ug/l), Olmstead (1.1 ug/l), Brule (1.2 ug/l), Big Clear, Camp, Cronk and Diamond Lakes (1.3 ug/l). The highest mean chlorophyll concentrations were calculated for Hay Bay (16.6 ug/l), Dog Lake (9.4 ug/l) and Cranberry Lake (9.2 ug/l).

Lakes are classified on a continually rising trophic (nutrient) scale according to their biological productivity. Lakes that have a low rate of nutrient supply in comparision to their size and therefore only sparse amounts of phytoplankton and other forms of aquatic life are oligotrophic. Lakes that have a high rate of nutrient supply in comparison to their size have large amounts of phytoplankton and are eutrophic. Mesotrophic lakes are intermediate between these two categories. The Ministry of the Environment chlorophyll a - trophic state criteria is presented below.

Trophic State	Chlorophyll a
Oligotrophic	0 - 2 ug/l
Mesotrophic	2 - 4 ug/l
Eutrophic	>4 ug/l

Lakes in the Self Help Program encompassed the entire range of trophic states on the lower end of the trophic continuum, but none approached

the highly enriched state, for example, of certain small prairie lakes which commonly attain chlorophyll concentrations of 100 to 400 ug/l.

Many water bodies are naturally eutrophic and these lakes may support a more productive warm water fishery (bass, pike, pickerel) than more oligotrophic lakes. Oligotrophic lakes, on the other hand, have greater multiple recreational use potential since their greater clarity will have more appeal for water contact recreation such as swimming and they may support a cold water fishery such as lake trout. The fish catch however will be less than in a more enriched lake since oligotrophic lakes do not have the food base (phytoplankton) to support a productive fishery. There are other factors of course besides water quality that affect the fishing in a lake. These include fishing pressure, the presence of adequate spawning grounds and nursery areas for fish fry such as weed beds.

Lakes that have a seasonal mean chlorophyll concentration greater than 5 ug/l, may experience intermittent algal "blooms" which temporarily interfere with swimming and bathing. Experience in the Southeastern Region indicates that if the mean chlorophyll concentration is greater than 15 to 20 ug/l, however, the frequency and severity of blooms becomes a problem. At these higher concentrations, the recreational and aesthetic appeal of the lake may be greatly diminished. High levels of algae also may make it difficult for more desirable fish species to survive.

As pointed out above, Secchi disc readings indicate the depth to which light penetrates into a lake and chlorophyll a is a photosynthetic pigment found in green plants. Since light penetration is affected by the amount of phytoplankton in the water, a good correlation exists between the chlorophyll a concentrations and Secchi disc readings in a series of lakes of varying degrees of aquatic enrichment. The curve in Figure 2 represents this relationship for the 74 water bodies in the 1979 Self Help Program.

Oligotrophic lakes which have low levels of chlorophyll and correspondingly deep light penetration, Camp (# 17), Big Clear (# 8), Palmerston (# 67), Brule (# 14) and Olmstead (# 63) are situated near the vertical arm of the curve in the upper left area of the graph. Lakes characterized by reduced water clarity and high chlorophyll concentrations, Hay Bay (# 46), Cranberry (# 27), Muskrat (# 61), lie along the horizontal arm in the lower right area. Mesotrophic lakes are clustered above the mid section of the curve.

The line depicting the relationship between water transparency (mean Secchi disc visibility depth) and the amount of phytoplankton in the lake (chlorophyll a concentration) is a hyperbolic curve. This means that a uniform or constant change in the concentration of chlorophyll along the horizontal axis of the graph does not result in a constant change in water clarity along the vertical axis. For example, a 2 ug/l increase in chlorophyll concentration from 2 to 4 ug/l produces a change of 1.4 metres in water clarity while an increase of 2 ug/l from 4 to 6 ug/l produces a change of less than 0.5 metres. Increases in chlorophyll

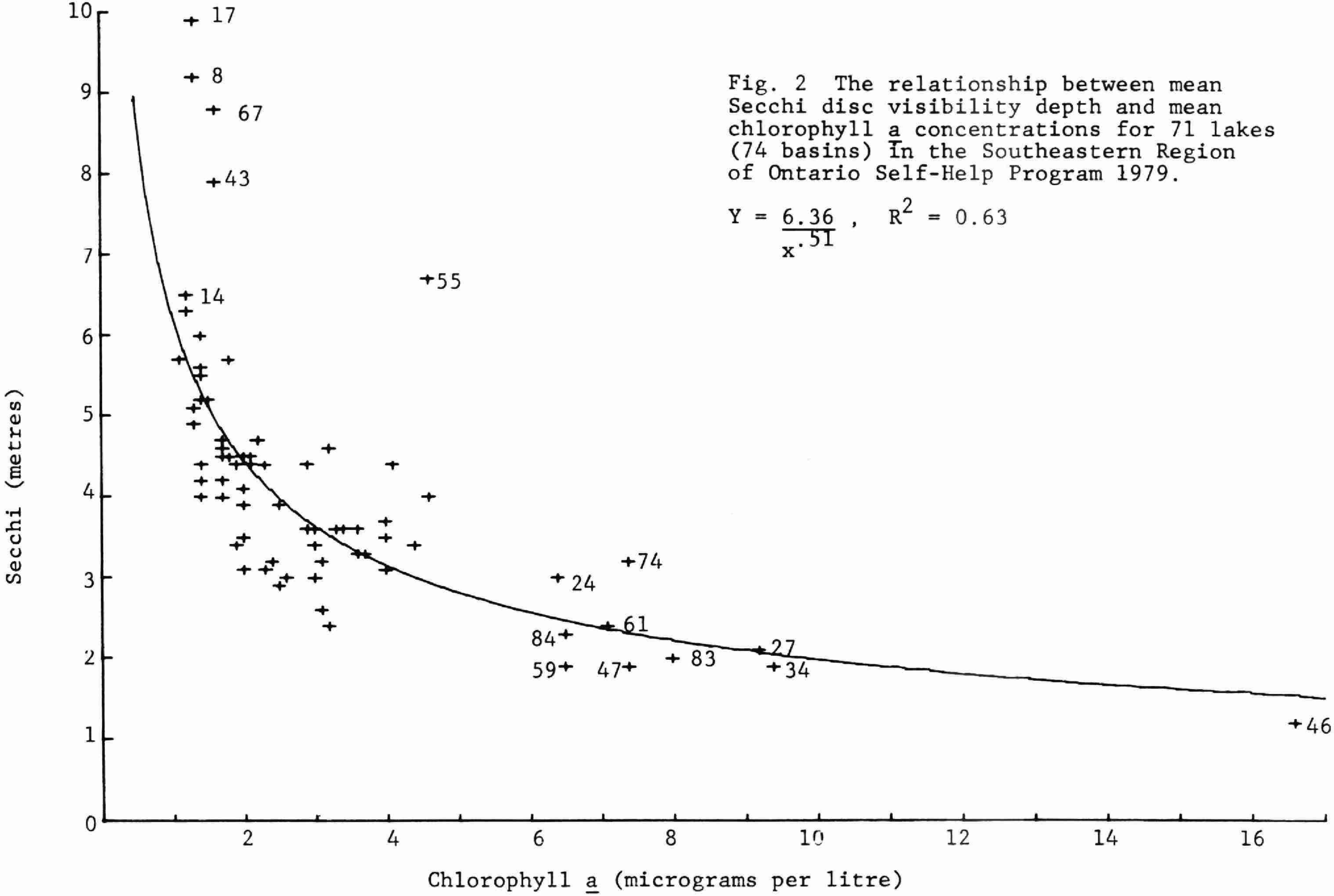

Fig. 2 The relationship between mean Secchi disc visibility depth and mean chlorophyll a concentrations for 71 lakes (74 basins) in the Southeastern Region of Ontario Self-Help Program 1979.

$$Y = \frac{6.36}{x^{.51}}, \quad R^2 = 0.63$$

cease to have any significant effect on water clarity at concentrations greater than 10 ug/l. One reason for this is that algae increase the chlorophyll content of their cells without increasing their numbers to compensate for poor light conditions caused by reduced transparency.

Conversely, there is a point beyond which a decrease in chlorophyll concentrations will not increase water transparency. At concentrations less than 2 ug/l, non algal turbidity, the natural colour of the water and other factors have a much greater effect on Secchi disc readings than phytoplankton. Big Clear Lake (# 17) and Brule Lake (# 14) have the same mean chlorophyll concentration of 1.2 ug/l, but the mean Secchi disc visibility depth of Big Clear Lake is 9.2 metres while for Brule Lake it is 6.5 metres.

In practical terms, there are limits within which changes in the trophic status or chlorophyll concentrations will improve or reduce water clarity. Mean Secchi disc visibility depths are best co-related to phytoplankton levels at chlorophyll concentrations between 2 ug/l and 10 ug/l.

If continued on a long term basis, measurements of water clarity and chlorophyll concentrations provide an excellent means of monitoring water quality. Some 57 lakes in the Self Help Program have now been sampled for a number of consecutive years (Table 3).

The greatest reduction in mean Secchi disc visibility depth from 1978 to 1979 was 1.2 metres, recorded for Dalhousie Lake (-26%), Little Silver Lake (-23%) and Bass Lake (-19%). Chlorophyll concentrations are less

Table 3: Mean values for Secchi disc visibility depths (metres) and chlorophyll a concentrations (micrograms per litre) for lakes in the Southeastern Region of Ontario with two or more years of 6 sets of measurements each available.

LAKE	1979		1978		1977		1976		1975		1974		1973		1972	
	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.
Ashby	5.6	1.4	6.4	1.5	6.8	1.3										
Baptiste	4.5	1.8	4.3	1.6	3.6	2.4			3.2	2.1						
Bass	4.7	1.7	5.9	1.5	6.6	1.0										
Big Rideau	4.4	2.3	4.5	2.0	4.0	1.4	4.1	2.3	4.5	1.6						
Black	5.2	1.5	4.9	1.6	5.0	1.3	4.1	1.4								
Bobs -Buck Bay	3.6	3.3	3.4	3.0	3.8	3.5	4.8	2.6								
Buck -North Bay	3.5	4.0	3.9	3.3	3.5	2.3										
Carson	5.7	1.8	6.2	1.9	6.3	1.3										
Charleston	3.9	2.5	3.8	2.4	4.0	2.2	4.9	2.9								
Christie	4.4	4.1	4.8	2.8	4.4	3.9	4.3	2.8								
Clear	4.2	1.7			3.5	1.8										
Collins Bay	3.0	6.4	3.2	4.1	3.3	3.2	2.8	3.5	2.8	4.2						
Cranberry	2.1	9.2	1.6	12.4	2.2	7.6										

	1979		1978		1977		1976		1975		1974		1973		1972	
	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.
Crowe	2.4	3.2	2.4	2.1	4.8	2.2	4.7	3.3			4.7	1.2			3.8	1.7
Dalhousie	3.4	1.9	4.6	1.4	4.1	1.6	3.9	2.3								
Desert	4.5	2.0	5.5	1.7	4.9	1.7										
Diamond	4.9	1.3	5.1	1.0												
Dore	4.7	2.2	4.5	2.5	4.8	2.0										
Eagle	4.7	2.2			4.3	1.3										
Gananoque	3.2	3.1	3.0	4.7	2.2	3.1										
Garskeys (Ellens)	3.4	3.0	3.5	3.2	3.5	2.2										
Glanmire	3.6	3.4	3.7	3.0	3.4	1.9	3.2	2.3	3.6	--						
Green	7.9	1.6	8.0	0.8	8.3	0.7	8.5	1.6								
Grippen	2.9	2.5	3.2	3.1	2.7	2.1	3.9	3.1	2.9	2.6						
Hay Bay	1.2	16.6	1.5	12.1	1.1	16.6										
Howes	1.9	7.4			2.4	4.1										
Hurds	4.4	2.9	4.5	2.2	4.7	2.1			4.8	1.7						
Kamaniskeg	4.5	1.7	4.6	2.2	5.1	1.4	4.5	1.2								

	1979		1978		1977		1976		1975		1974		1973		1972	
	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.
Kennebec	3.2	2.4	3.5	2.2	3.7	1.9	4.1	2.7								
Limerick	4.4	1.4	4.9	1.3	4.7	1.5	4.7	1.0	5.0	1.1						
Little Silver	4.0	4.6	5.1	2.6	4.2	5.0										
Loughborough																
east basin	3.3	3.6	3.0	3.6	2.8	3.7	3.4	2.1	2.3	4.9	2.7	2.7	3.3		3.1	2.6
west basin	4.0	2.0	3.9	1.8	3.4	2.2	4.5	2.5	4.1	2.1			4.0			
Mackie	6.7	4.6	6.1	2.5	6.3	1.8	6.0	1.3					6.6	0.5		
Mazinaw	5.2	1.4	5.6	1.0	5.7	1.2	5.6	1.2	5.6	1.0						
Mink	4.2	1.4	4.3	1.6	3.5	1.5	3.6	1.8	3.8	1.8						
Moira																
west basin	1.9	6.5							1.6	11.9	1.7	9.3	1.6	10.4	1.1	26.0
Mosque																
N.W. basin	4.6	3.2	4.5	3.7	3.9	2.9										
main basin	5.5	1.4	5.7	1.5	5.1	1.7										
Muskrat	2.4	7.1	2.7	6.6	1.7	10.3										
Olmstead	6.3	1.2	6.6	1.3	6.3	1.4										
Opinicon	3.3	3.7	3.0	3.6	2.8	2.6										
Otter	3.1	2.3	3.3	2.0	3.0	2.1	3.2	2.4	3.2	1.4						

	1979		1978		1977		1976		1975		1974		1973		1972	
	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.	SD	chl.
Otty	4.4	2.1	4.2	2.1	4.0	1.7	4.5	1.8	4.5	1.8	3.8	1.1	4.1	1.9		
Palmerston	8.8	1.6	8.2	1.4	7.1	1.6										
Pike	3.7	4.0	4.2	2.8	3.1	4.0	2.4	4.4								
Round	4.5	2.0			4.6	2.2										
St. Peter	3.5	2.0					3.6	1.9								
Salmon Trout	3.2	7.4	4.2	5.0			3.4	6.6			3.7	1.4				
Sharbot																
east basin	3.1	2.0	2.8	1.9												
west basin	4.4	1.9	4.8	1.8	4.2	1.7	4.1	2.0								
Silver	4.1	2.0	3.5	1.8	3.5	1.6										
Steenburg	4.5	2.1	4.2	2.0	4.7	2.0	4.3	1.3								
Sydenham	3.6	3.0	3.6	2.1	5.0	3.4										
Temperance	2.6	3.1	2.2	2.8	1.2	8.9	1.9	7.7								
Thirty Is.	4.6	1.7	5.0	2.2	5.0	2.6										
Troy	2.0	8.0	1.9	7.4	1.7	6.9										
Verona (Rock)	2.3	6.5			2.1	7.0										
White (86)	3.0	3.0	3.2	3.7	2.8	3.6	2.3	6.4	3.1	3.5	3.0	2.2	2.6	4.2	1.8	4.8
Whitefish	3.0	2.6	2.7	3.4	2.6	4.4										

than 2 ug/l in Bass and Dalhousie Lakes. Therefore, changes in Secchi disc visibility must be attributed to non algal particulate matter, weather conditions as they affect light penetration into the lake and possibly subjective error in determining Secchi disc depths rather than to phytoplankton.

The seasonal mean chlorophyll concentration in Little Silver Lake increased from 2.6 to 4.6 ug/l from 1978 to 1979, thus accounting for the reduction in water clarity in its waters during 1979. Based on the sampling program in 1978, Little Silver Lake starts the season with crystal clear water and gradually accumulates algal biomass as the growing season progresses. Sampling in 1979 and 1977 did not document early season conditions as the sampling did in 1978. Therefore, the apparent year to year variations in mean Secchi disc visibility depths and chlorophyll concentrations for Little Silver Lake have been introduced in a large part by seasonal biases in sampling rather than any intrinisic variation in its water quality.

In terms of percent change in water clarity, the greatest differences in mean Secchi disc visibility depths were -24% (-1.0 metre) recorded for Salmon Trout Lake and +31% (+0.5 metres) for Cranberry Lake. The change in water clarity in Salmon Trout Lake was accompanied by an increase in the mean chlorophyll concentration from 5.0 ug/l in 1978 to 7.2 ug/l in 1979. The apparent increase in productivity of Salmon Trout Lake, like that of Little Silver Lake, may be attributed in part to a seasonal bias by inclusion of several sampling dates in October when Salmon Trout Lake was experiencing an autumnal maximum in its phytoplankton levels.

A considerable decrease in mean chlorophyll concentration from 12.4 to 9.2 ug/l in Cranberry Lake from 1978 to 1979 accompanied the improvement in its water clarity. Other lakes that experienced substantial changes in their seasonal chlorophyll concentrations were Hay Bay (+4.4 ug/l), Howes Lake (+3.3 ug/l), Collins Bay (+2.3 ug/l), Mackie Lake (+2.1 ug/l), and Moira Lake (-9.4 ug/l). In most cases, the chlorophyll concentrations in these lakes are high (means 4.1 to 9.2 ug/l) so that the differences in their mean values from one year to the next are within the range of expected annual variation for these lakes.

Similarly, for most other lakes, differences in seasonal mean Secchi disc visibility depths and chlorophyll concentrations are the result of normal year to year variations in climate, the nutrient level of the lakes, other natural factors, extent and regularity of sampling, and analytical error. In this regard, it is noted that in general most of those lakes (Temperance, Muskrat, Pike, Hay Bay, Cranberry, Salmon Trout, Little Silver, Kamaniskeg and Mackie) for which further surveillance of water quality was specifically recommended in last year's (1978) report based on the magnitude of the apparent change in the water quality from the previous year (1977) tended to revert to more historic Secchi disc depths and chlorophyll levels in 1979. (See Table 3).

Temperance Lake, however, continued to exhibit the same improvement in water clarity and reduction of chlorophyll levels experienced in 1978. Temperance Lake is shallow (4.6 metres) and water clarity and the phytoplankton population may be influenced in some years by wind induced disturbance of the lake bottom. Resuspension of bottom

sediment could reduce water clarity with inorganic particulate matter and promote the growth of algae by releasing large quantities of phosphorus trapped in muds back into the water column of the lake.

A considerable decrease in chlorophyll concentration in Moira Lake was evident from 1972 to 1973 and this lower level has persisted until present. The Village of Madoc (population 1240) discharges its sewage waste to Moira Lake via Deer Creek. As part of a provincial policy to reduce controllable nutrient sources to inland recreational lakes, seasonal retention and phosphorus removal facilities became operational at Madoc during 1973. While the continued high level of fertility in Moira Lake is undoubtedly related to natural sources of phosphorus and nitrogen, a "cautiously optimistic" view is that the apparent reduction in chlorophyll levels and somewhat better water clarity experienced in recent years may be related to the reduction of the artificial phosphorus supply and by elimination of the sewage discharge from the Village of Madoc during the growing season.

Mackie Lake has undergone a gradual increase in its seasonal mean chlorophyll concentration since 1976 for which there is no readily apparent explanation. Further study is required to determine if the increase in chlorophyll concentration has affected other water quality conditions in Mackie Lake.

RECOMMENDATIONS

The study of inland lakes is a relatively young and inexact science. In view of the annual variations in mean Secchi disc visibility depths and chlorophyll concentrations, sampling is required over a number of years to establish the trophic character of lakes, to determine if any long term trends are materializing, and to gain a better understanding into the processes governing their water quality. Participants are asked to consider a continuation of the Secchi disc-chlorophyll sampling on their lakes.

Biological processes are subjected to considerable variability. Phytoplankton populations vary spatially within a lake and they also vary temporally with the seasons. In order to reduce spatial variability, water clarity measurements and chlorophyll collections should be undertaken at a deep open water area of the lake well removed from the extraneous influences of the lake bottom, islands or projecting shorelines and rooted aquatic weeds.

As has been indicated, some lakes experience their maximum productivity in the spring and/or fall, while other lakes exhibit maximum productivity in the summer. In order to avoid the introduction of a seasonal bias into the results, sampling should be undertaken on a weekly or bi-weekly basis evenly spaced throughout the sampling program. In this regard, the Ministry of the Environment should give consideration to re-defining seasonal mean chlorophyll concentration and mean Secchi disc visibility

depth as the average of monthly means in order that all months will be weighted equally in these calculations. Specifically, it is recommended that sampling programs should be carried out for at least three months (June, July, August) and preferably over a longer interval depending upon the samplers' availability of the lakes.

Mackie Lake was identified as a "highly sensitive" lake relative to its available lake trout habitat in the report on Water Quality Management of Lake Trout Waters in Southeastern Ontario, 1977. Since chlorophyll concentrations have increased steadily since 1976, Mackie Lake should receive consideration for re-survey by the Ministry of the Environment to determine in particular if there has been a change in its deep water dissolved oxygen concentrations or not.

With the many thousands of lakes in the province, the Ministry of the Environment does not have the fiscal or logistical resources to collect water quality information from all of them on a regular basis. For this reason, the Ministry of the Environment wishes to encourage the expansion of the Self Help Program to include lakes that are not presently enrolled. Further, the Self Help Program provides a mechanism to directly educate the public about the causes and consequences of eutrophication. For information and assistance in establishing a Self Help Program, write to: Self Help Program, Ontario Ministry of the Environment, P.O. Box 820, 133 Dalton Street, Kingston, Ontario K7L 4X6 (Telephone: 549-4000).

Table 4: Secchi disc visibility depths (metres) and chlorophyll *a* concentrations (micrograms per litre) data collected from 88 lakes in the Southeastern Region of Ontario during the summer of 1979. Mean and standard deviation values are also presented.

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
1.	Albion	June 30	2.6	1.9
		July 9	3.3	3.7
		July 15	2.7	1.4
		July 23	4.3	4.0
		July 29	4.0	3.0
		Aug 8	3.8	6.9
		Aug 13	3.2	4.2
		Aug 26	4.0	5.0
		Sept 5	4.0	6.2
		Sept 9	3.7	2.9
		Sept 16	3.8	1.0
		Sept 23	3.7	2.6
		MEAN	3.59	3.57
		STANDARD DEVIATION	0.53	1.82
2.	Ashby	May 21	3.7	2.0
		May 26	5.2	2.2
		June 10	4.3	1.2
		June 17	4.6	0.9
		July 2	4.6	1.2
		July 15	5.5	0.6
		July 23	6.1	1.2
		Aug 6	5.8	1.7
		Aug 26	7.0	1.7
		Sept 3	6.7	0.9
		Sept 16	6.4	1.6
		Oct 8	6.7	1.7
		Nov 3	6.1	1.1
		MEAN	5.59	1.35
		STANDARD DEVIATION	1.04	0.46
3.	Baptiste #1.	July 3	4.2	2.8
		July 25	4.0	1.4
		Aug 8	4.6	1.7
		Aug 23	4.3	1.3
		Sept 4	5.3	1.8
		Sept 15	4.4	1.8
		Sept 23	4.9	2.1
		Oct 21	4.6	0.9
		Nov 12	5.2	1.3
		MEAN	4.61	1.68
		STANDARD DEVIATION	0.45	0.55

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
	Baptiste (cont'd) #2	July 3	3.7	2.6
		July 25	3.8	1.4
		Aug 8	4.4	1.4
		Aug 23	4.1	1.5
		Sept 4	5.2	1.8
		Sept 15	4.3	1.9
		Sept 23	5.3	1.4
		Sept 30	3.4	4.4
		Oct 21	4.4	0.8
		Nov 12	4.6	1.1
		MEAN	4.32	1.83
		STANDARD DEVIATION	0.61	1.03
4.	Bass	June 17	4.3	1.9
		July 23	4.9	1.5
		Aug 7	--	1.7
		Aug 7	--	1.9
		Aug 7	--	1.7
		Aug 7	--	1.1
		Aug 26	5.2	1.9
		Sept 3	5.2	1.4
		Sept 3	4.4	1.3
		Sept 9	4.0	1.8
		Sept 9	5.2	1.9
		Sept 16	4.6	2.2
		MEAN	4.73	1.69
		STANDARD DEVIATION	0.47	0.31
5.	Bay	July 22	- -	0.7
		July 30	2.6	0.4
		Aug 13	4.3	1.1
		Aug 15	4.3	0.9
		Aug 22	7.6	1.5
		MEAN	4.70	0.92
		STANDARD DEVIATION	2.09	0.41
6.	Bellamy	May 20	1.8	1.1
		May 27	1.8	1.6
		June 17	2.2	1.1
		June 3	2.0	1.0
		Sept 4	1.8	1.2
		MEAN	1.92	1.20
		STANDARD DEVIATION	0.18	0.12

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL *a* (ug/l)
7.	Bennett	July 2	3.2	3.2
		July 16	2.9	2.7
		Sept 16	2.0	12.6
		MEAN	2.70	6.17
		STANDARD DEVIATION	0.62	5.58
8.	Big Clear	June 20	9.2	1.2
		July 3	9.2	1.4
		July 13	9.2	1.8
		July 18	-	0.9
		Aug 1	9.2	1.0
		Aug 5	-	1.4
		Aug 19	9.2	1.6
		Aug 25	9.4	1.1
		Sept 3	8.8	1.2
		MEAN	9.17	1.29
		STANDARD DEVIATION	0.18	0.29
9.	Big Gull	July 8	4.0	2.5
		July 22	3.2	1.8
		July 29	4.3	1.8
		Sept 3	4.6	1.8
		Sept 16	4.6	2.1
		MEAN	4.14	2.00
		STANDARD DEVIATION	0.58	0.31
10.	Big Rideau	June 24	3.8	2.9
		July 8	5.2	1.9
		July 22	4.6	1.4
		July 22	5.2	2.0
		Aug 6	4.3	2.9
		Aug 26	4.6	2.6
		Sept 3	3.7	2.1
		Sept 23	4.0	2.8
		Oct 14	4.0	2.1
		MEAN	4.38	2.30
		STANDARD DEVIATION	0.56	0.52
11.	Black	May 30	4.9	1.8
		June 13	4.6	2.3
		June 27	5.5	1.7
		July 11	5.5	1.2
		July 25	4.9	0.8
		Aug 9	5.8	1.4
		MEAN	5.20	1.53
		STANDARD DEVIATION	0.46	0.52

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
12.	Bob's Lake			
	Buck Bay	May 20	4.6	1.1
		April 21	2.9	1.7
		June 17	3.7	2.0
		June 2	3.7	3.1
		Aug 13	3.4	6.4
		Sept 1	3.4	3.7
		Oct 8	3.7	4.9
		MEAN	3.63	3.27
		STANDARD DEVIATION	0.52	1.89
	Green Bay	May 12	5.2	1.0
		June 24	5.5	1.3
		July 8	6.8	3.1
		MEAN	5.84	1.80
		STANDARD DEVIATION	0.81	1.13
13.	Boulter	June 30	3.4	--
			3.7	--
		July 8	3.4	--
		July 21	3.7	--
		Aug 12	3.7	--
		MEAN	3.58	--
		STANDARD DEVIATION	0.16	--
14.	Brule	May 27	5.7	1.9
		June 3	7.1	1.7
		June 26	5.5	1.2
		June 29	6.5	0.5
		July 5	6.2	0.8
		July 13	7.3	1.3
		July 20	7.7	0.9
		Aug 1	6.6	1.4
		Aug 3	6.4	1.3
		Aug 24	5.5	1.3
		Aug 26	6.7	1.4
		Aug 31	7.0	0.8
		MEAN	6.52	1.21
		STANDARD DEVIATION	0.71	0.40

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
15.	Buck			
	North Bay (South end)			
		July 2	3.5	4.8
		July 8	4.2	3.7
		July 22	4.0	2.9
		July 29	3.8	3.0
		Aug 5	3.2	3.4
		Aug 12	3.0	4.9
		Aug 19	3.4	4.5
		Aug 26	3.4	5.8
		Sept 3	3.2	5.3
		MEAN	3.52	4.26
		STANDARD DEVIATION	6.40	1.04
	North Bay (North end)			
		July 17	2.9	2.3
		July 23	3.2	3.4
		July 29	3.5	1.7
		Aug 6	2.9	3.3
		Aug 12	2.7	4.2
		Aug 19	2.9	4.5
		Aug 27	2.7	5.1
		Sept 3	2.9	4.2
		Sept 23	3.4	4.1
		Sept 29	3.7	4.0
		MEAN	3.08	3.70
		STANDARD DEVIATION	0.35	0.98
16.	Buckshot	June 17	3.0	--
		July 7	4.3	0.8
		July 15	3.7	0.8
		Sept 3	4.7	1.6
		Oct 8	5.0	1.2
		MEAN	4.14	1.10
		STANDARD DEVIATION	0.80	0.38
17.	Camp Lake (Little Mackie)			
		June 24	9.2	0.7
		July 1	10.3	1.0
		July 7	10.4	0.8
		July 15	9.2	1.5
		July 22	10.4	1.4
		Aug 6	9.4	1.7
		Aug 13	9.8	2.0
		Aug 24	10.7	1.3
		MEAN	9.93	1.30
		STANDARD DEVIATION	0.60	0.45

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
18. Canoe	May 21	6.3	1.5
	May 27	4.6	1.7
	June 3	6.0	4.3
	June 10	4.2	0.8
	June 17	6.3	0.8
	June 24	6.0	1.5
	June 31	6.0	0.9
	July 8	6.0	0.8
	July 15	6.2	0.8
	July 23	7.5	0.9
	July 29	7.3	1.1
	Aug 12	5.8	1.5
	Aug 12	6.4	1.3
	Sept 3	5.8	--
	MEAN	6.03	1.38
	STANDARD DEVIATION	0.86	0.94
19. Carson	May 30	5.4	2.3
	June 6	6.0	1.3
	June 13	5.5	1.4
	June 19	5.8	2.1
	June 26	5.5	1.9
	July 3	4.9	2.2
	July 10	5.5	1.6
	July 18	5.8	2.2
	July 24	6.1	1.8
	July 31	5.8	1.9
	Aug 12	5.0	1.3
	Aug 14	5.8	2.0
	Aug 22	6.4	1.7
	Aug 28	6.1	1.6
	MEAN	5.69	1.81
	STANDARD DEVIATION	0.42	0.34
20. Charleston Big Water	June 15	2.8	2.7
	June 19	3.6	2.7
	June 25	3.5	3.1
	July 3	3.8	1.5
	July 10	3.7	1.5
	July 17	3.2	1.4
	July 24	4.3	1.8
	July 31	2.4	2.7
	Aug 7	3.8	2.6
	Aug 14	3.8	3.2
	Aug 28	3.7	3.5
	Sept 4	3.4	3.7
	Sept 11	3.8	3.0
	Sept 18	2.7	4.0
	MEAN	3.46	2.67
	STANDARD DEVIATION	0.52	0.84

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
Deep Water	June 15	2.8	2.7
	June 19	4.3	2.7
	June 25	4.5	2.7
	July 3	4.0	0.6
	July 10	4.2	1.6
	July 17	3.4	1.9
	July 24	4.4	1.4
	July 31	1.8	2.7
	Aug 7	3.7	2.3
	Aug 14	4.3	2.1
	Aug 28	3.7	2.6
	Sept 4	3.7	3.0
	Sept 11	3.7	3.0
	Sept 18	2.7	4.0
	MEAN	3.66	2.38
	STANDARD DEVIATION	0.77	0.83
Webster Bay	June 19	3.8	2.9
	June 25	5.1	--
	July 3	4.1	1.2
	July 10	4.8	2.0
	July 17	4.7	--
	Aug 1	3.7	1.7
	Aug 7	4.0	2.2
	Aug 14	5.3	2.6
	MEAN	4.40	2.10
	STANDARD DEVIATION	0.56	0.61
Western Water	June 19	4.0	2.7
	June 25	4.5	2.9
	July 3	4.7	6.8
	July 10	4.3	1.7
	July 17	4.9	--
	Aug 1	4.0	1.6
	Aug 14	5.3	2.8
	MEAN	4.53	3.08
	STANDARD DEVIATION	0.48	1.91
Goose Island	June 19	3.8	2.9
	June 25	3.7	2.4
	July 3	4.0	1.0
	July 10	4.6	1.9
	July 17	5.1	--
	Aug 1	4.2	1.7
	Aug 7	4.1	2.3
	Aug 14	4.1	2.4
	MEAN	4.21	2.09
	STANDARD DEVIATION	0.48	0.61

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
21. Chippego	May 21	2.8	6.1
	May 27	2.5	5.8
	June 3	2.5	6.5
	June 10	2.5	4.4
	June 17	2.6	3.0
	June 24	2.5	2.9
	July 2	3.1	2.9
	July 8	3.4	4.9
	July 15	3.4	5.0
	July 29	3.8	3.7
	Aug 2	3.4	3.0
	Aug 11	3.4	3.4
	Aug 19	3.5	3.2
	Aug 31	3.4	3.4
	Sept 4	3.7	3.8
	Sept 25	3.5	3.7
	Sept 30	3.2	3.0
	Oct 7	3.2	3.2
	Oct 14	3.0	3.7
	Oct 28	3.0	3.9
	Nov 9	2.9	--
	MEAN	3.11	3.98
	STANDARD DEVIATION	0.42	1.11
22. Christie	June 24	5.8	1.1
	July 15	5.8	--
	Aug 12	4.9	2.3
	Aug 26	4.6	3.3
	Sept 9	3.9	3.0
	Sept 23	3.0	6.1
	Oct 14	2.7	8.8
	MEAN	4.39	4.10
	STANDARD DEVIATION	1.25	2.83
23. Clear east	July 9	4.9	1.1
	July 12	8.2	1.1
	July 14	5.8	0.9
	Aug 12	3.8	2.0
	Aug 26	3.5	1.8
	Sept 2	2.3	2.5
	Sept 9	2.0	1.5
	Sept 16	2.6	2.7
	Sept 23	3.5	2.5
	Sept 30	3.5	2.0
	Oct 9	3.7	2.5
	Oct 21	3.8	2.2
	MEAN	3.97	1.90
	STANDARD DEVIATION	1.69	0.62

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
	Clear cont'd west	July 9	4.5	1.2
		July 12	7.3	1.0
		July 14	5.8	0.9
		July 22	8.2	1.1
		July 27	4.4	0.7
		Aug 12	4.4	2.3
		Aug 26	3.7	1.3
		Sept 2	3.0	1.5
		Sept 9	3.0	2.1
		Sept 16	2.9	1.3
		Sept 30	3.8	2.2
		Oct 8	3.5	2.6
		Oct 21	3.8	2.3
		MEAN	4.41	1.64
		STANDARD DEVIATION	1.61	0.66
24.	Collins Bay	May 20	2.5	13.6
		June 24	3.2	4.0
		July 29	2.6	3.2
		Aug 22	2.9	4.8
		Sept 16	3.8	5.7
		Oct 5	3.2	6.8
		MEAN	3.03	6.35
		STANDARD DEVIATION	0.48	3.77
25.	Colton	Aug 8	6.2	1.2
		Sept 2	4.7	0.8
		Sept 9	5.0	1.2
		Sept 16	6.0	1.2
		Sept 23	6.3	1.1
		Oct 8	6.0	1.0
		MEAN	5.70	1.08
		STANDARD DEVIATION	0.68	0.16
26.	Constant (Constan)			
		June 5	3.1	1.1
		June 14	3.7	0.8
		June 20	4.6	0.9
		June 29	3.7	1.2
		July 6	4.6	1.2
		July 11	4.3	0.3
		July 17	3.7	1.0
		July 26	4.6	3.7
		July 31	4.0	0.7

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
	Constant (cont'd)			
		Aug 14	3.7	1.7
		Aug 26	4.3	1.5
		Aug 31	4.3	1.7
		Sept 4	4.0	2.1
		MEAN	4.05	1.38
		STANDARD DEVIATION	0.46	0.85
27.	Cranberry	June 4	3.2	3.2
		June 15	2.5	4.8
		June 20	2.9	6.2
		July 3	2.3	7.4
		July 9	2.3	8.5
		July 12	2.3	6.1
		July 19	1.8	7.7
		July 27	1.9	2.3
		Aug 1	1.7	11.8
		Aug 9	1.8	16.2
		Aug 16	1.8	12.6
		Aug 30	1.8	8.9
		Sept 11	1.4	14.4
		Sept 19	1.8	13.8
		Oct 4	1.9	14.6
		MEAN	2.09	9.23
		STANDARD DEVIATION	0.49	4.41
28.	Cronk	July 3	5.0	0.9
		July 15	5.6	0.6
		July 22	5.2	0.9
		July 30	5.3	2.3
		Aug 16	4.7	1.1
		Aug 22	4.6	1.0
		Sept 4	5.0	1.7
		Sept 16	5.2	2.2
		Sept 24	4.9	1.4
		MEAN	5.06	1.34
		STANDARD DEVIATION	0.31	0.60
29.	Crosby	Aug 19	3.4	3.6
		Aug 26	3.6	4.9
		Sept 3	3.0	3.4
		Sept 8	3.7	6.9
		MEAN	3.43	4.70
		STANDARD DEVIATION	0.31	1.61

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
30. Crowe	July 8	2.6	2.2
	July 22	2.7	1.0
	July 29	2.9	2.0
	Aug 6	2.4	1.5
	Aug 12	2.6	2.3
	Aug 26	2.4	4.1
	Sept 3	2.1	4.6
	Sept 9	2.4	4.9
	Sept 15	2.3	4.2
	Sept 23	2.1	5.7
	MEAN	2.45	3.25
	STANDARD DEVIATION	0.25	1.63
31. Dalhousie	July 8	3.2	1.2
	July 15	2.9	0.9
	July 22	3.4	1.3
	July 22	2.6	1.0
	July 23	5.0	1.3
	Aug 1	3.7	0.9
	Aug 7	3.0	1.6
	Aug 12	3.0	2.3
	Aug 12	3.4	1.4
	Aug 12	3.7	1.3
	Aug 19	4.0	1.3
	Aug 26	4.9	2.2
	Aug 26	3.7	4.0
	Sept 3	3.0	1.8
	Sept 23	2.2	6.2
	MEAN	3.45	1.91
	STANDARD DEVIATION	0.77	1.42
32. Desert #1	May 13	4.8	3.5
	May 19	4.0	2.9
	May 27	3.4	2.2
	June 3	5.1	2.3
	June 10	4.7	2.8
	June 25	4.6	2.7
	July 2	4.3	1.7
	July 8	4.6	1.1
	July 21	4.9	1.3
	Aug 6	4.9	2.4
	Aug 16	3.7	3.1
	Aug 26	4.7	2.0
	MEAN	4.48	2.33
	STANDARD DEVIATION	0.52	0.72

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
#2	May 13	4.6	2.8
	May 19	4.3	2.6
	May 27	3.4	--
	June 3	4.9	2.6
	June 10	4.6	2.4
	June 25	4.0	2.3
	July 2	4.5	1.8
	July 8	4.8	1.2
	July 21	5.1	1.4
	Aug 6	4.3	1.9
	Aug 16	3.4	1.5
	Aug 26	3.8	1.3
	MEAN	4.31	1.98
	STANDARD DEVIATION	0.56	0.58
#3	June 24	5.4	0.4
	July 2	4.9	1.2
	July 22	5.0	0.5
	Aug 6	5.0	1.4
	MEAN	5.08	0.88
	STANDARD DEVIATION	0.22	0.50
33. Diamond	July 27	4.6	--
	Aug 16	5.5	1.2
	Aug 27	4.9	1.4
	Sept 8	4.6	1.2
	Sept 16	4.9	1.4
	Oct 7	4.9	1.3
	MEAN	4.90	1.30
	STANDARD DEVIATION	0.33	0.10
34. Dog	June 21	2.6	4.1
	July 2	2.3	4.7
	July 15	2.3	4.5
	July 18	2.0	9.2
	July 31	1.0	17.2
	Aug 6	1.4	14.0
	Aug 14	1.6	12.0
	Sept 3	2.0	8.6
	Sept 11	2.0	10.0
	MEAN	1.91	9.37
	STANDARD DEVIATION	0.50	4.53
35. Dore	June 26	4.8	2.4
	July 9	5.1	2.1
	Aug 6	4.6	1.5

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL *a* (ug/l)
Dore (cont'd)			
	Aug 26	4.9	2.5
	Sept 5	4.4	2.4
	Sept 16	4.3	2.1
	MEAN	4.68	2.17
	STANDARD DEVIATION	0.31	0.37
Eagle			
#1	May 21	4.8	2.9
	June 3	4.2	2.2
	June 17	4.6	1.8
	June 24	4.9	2.2
	July 2	4.2	1.5
	July 8	4.9	1.2
	July 15	4.8	1.4
	July 23	5.5	1.5
	Aug 12	4.9	2.1
	Aug 26	4.9	2.3
	Sept 3	4.6	2.2
	Sept 9	4.3	1.9
	Sept 16	4.9	2.0
	Sept 22	4.6	2.0
	Sept 30	4.3	2.1
	MEAN	4.69	1.95
	STANDARD DEVIATION	0.34	0.43
#2	May 21	4.8	2.2
	May 27	3.8	3.2
	June 3	3.4	2.8
	June 10	5.0	2.0
	June 17	5.3	2.0
	June 24	5.1	2.3
	July 2	4.8	2.1
	July 8	5.1	1.1
	July 22	5.0	1.8
	July 29	5.0	3.8
	Aug 6	4.6	2.5
	Aug 12	4.4	1.9
	Aug 19	4.7	2.4
	Aug 26	5.0	2.8
	Sept 3	5.0	1.9
	Sept 9	4.7	2.2
	Sept 16	5.0	2.8
	Sept 22	4.7	3.2
	Sept 30	4.6	2.3
	Oct 8	4.6	3.7
	MEAN	4.73	2.45
	STANDARD DEVIATION	0.45	0.67

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
37. Gananoque Lake			
	June 3	2.8	0.9
	June 17	2.5	2.4
	June 24	3.2	4.0
	July 2	3.4	3.1
	July 9	3.1	3.8
	July 22	2.7	2.9
	July 29	3.4	4.4
	Aug 19	3.2	3.3
	Sept 3	3.7	2.2
	Sept 9	3.7	1.9
	Sept 23	3.0	4.8
	Sept 30	3.5	3.6
	MEAN	3.18	3.11
	STANDARD DEVIATION	0.38	1.12
38. Garskeys (Ellens)			
	May 20	2.8	1.8
	May 27	2.5	1.9
	June 3	2.9	1.4
	June 10	2.8	1.9
	June 17	3.2	1.7
	July 9	5.7	1.3
	July 22	4.6	1.6
	Aug 7	3.7	2.1
	Aug 26	4.3	2.8
	Sept 2	4.3	1.7
	Sept 9	2.4	6.6
	Sept 16	2.1	6.2
	Sept 23	2.3	8.2
	MEAN	3.35	3.02
	STANDARD DEVIATION	1.09	2.34
39. Glanmire	June 3	5.5	1.4
	June 10	3.4	1.7
	June 17	3.1	1.8
	June 25	3.1	3.8
	Aug 6	5.2	3.6
	Aug 11	4.9	2.0
	Aug 26	3.7	3.0
	Sept 3	4.9	3.1
	Sept 16	2.4	3.0
	Sept 23	2.4	8.8
	Sept 30	1.5	5.3
	MEAN	3.65	3.41
	STANDARD DEVIATION	1.32	2.12

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
40. Golden	June 28	3.9	1.8
	July 4	3.5	2.5
	July 11	3.6	1.6
	July 25	3.4	1.1
	July 31	3.5	1.3
	Aug 3	4.3	1.2
	Aug 8	3.7	1.3
	July 4	3.7	1.9
	July 8	4.3	1.8
	July 9	4.3	2.1
	July 18	4.4	--
	Aug 26	4.3	1.9
	Aug 27	3.7	1.6
	Sept 3	4.6	1.4
	Sept 16	4.0	2.4
	MEAN	3.95	1.71
	STANDARD DEVIATION	0.39	0.43
41. Gorman	July 13	2.1	2.0
42. Graphite	June 3	2.8	1.4
	June 17	2.2	1.7
	MEAN	2.5	1.55
43. Green	May 27	8.9	0.8
	June 3	4.7	1.2
	June 10	6.0	1.0
	June 17	7.8	1.0
	July 2	6.5	0.7
	July 8	7.5	0.5
	July 15	8.2	2.9
	Aug 11	9.9	2.9
	Sept 3	8.1	2.9
	Sept 16	9.2	2.4
	Sept 23	10.1	1.9
	MEAN	7.90	1.65
	STANDARD DEVIATION	1.66	0.96
44. Grippen	July 2	2.0	3.7
	July 12	2.9	1.4
	July 16	3.2	2.1
	July 23	2.9	1.9
	July 27	2.6	2.3
	Aug 6	2.4	3.0
	Sept 3	3.5	2.2
	Sept 16	3.8	3.4
	MEAN	2.91	2.50
	STANDARD DEVIATION	0.59	0.79

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
45. Hambley (Silver)			
	Aug 13	3.0	3.0
	Sept 3	3.0	3.0
	Sept 9	3.8	5.7
	Sept 16	3.0	8.1
	Sept 23	3.0	2.8
	MEAN	3.15	4.52
	STANDARD DEVIATION	0.36	2.33
46. Hay Bay	April 20	1.4	13.8
	April 30	1.5	8.6
	May 10	1.5	9.6
	May 22	1.1	5.6
	June 1	2.0	9.5
	June 19	1.8	5.6
	June 20	2.2	5.6
	July 4	1.2	8.1
	July 11	1.4	8.2
	July 19	1.2	7.6
	July 30	1.2	11.1
	Aug 9	1.0	21.9
	Aug 9	1.1	22.2
	Aug 13	1.1	20.5
	Aug 22	0.8	28.0
	Aug 22	0.8	28.5
	Aug 26	0.8	15.4
	Sept 5	0.7	27.6
	Sept 11	0.9	--
	Sept 24	0.9	27.4
	Sept 25	0.9	28.8
	Oct 10	0.9	34.5
	Nov 14	1.2	15.4
	Nov 21	1.1	18.6
	MEAN	1.20	16.61
	STANDARD DEVIATION	0.39	9.17
47. Howes	July 4	3.2	6.8
	July 4	2.3	5.2
	July 4	2.3	5.8
	July 13	2.3	5.5
	July 13	2.2	5.1
	July 25	1.7	5.1
	July 28	1.7	6.0
	July 30	2.1	5.1
	Aug 18	1.4	11.8
	Aug 19	1.4	11.0

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL *a* (ug/l)
	Howes (cont'd)			
		Aug 21	1.2	8.9
		Sept 29	1.7	8.6
		Sept 30	1.7	8.9
		Oct 2	1.4	9.9
		MEAN	1.90	7.41
		STANDARD DEVIATION	0.53	2.38
48.	Hurds	July 2	3.4	2.3
		July 22	3.8	2.3
		July 25	3.4	1.7
		July 29	5.3	1.5
		Aug 6	4.9	2.0
		Aug 12	4.9	2.5
		Aug 25	5.0	4.2
		Sept 3	4.0	3.1
		Sept 9	5.0	5.2
		Sept 16	4.0	4.3
		MEAN	4.37	2.91
		STANDARD DEVIATION	0.72	1.25
49.	Joe Perry	June 13	3.7	2.1
		June 27	3.7	2.8
		July 11	2.8	1.8
		Aug 9	4.3	1.8
		MEAN	3.63	2.13
		STANDARD DEVIATION	0.62	0.47
50.	Kamaniskeg (east of Mask Island)			
		May 23	3.7	2.5
		May 28	3.7	1.0
		June 5	4.6	1.2
		June 11	3.1	2.1
		June 18	4.6	--
		June 25	4.9	1.9
		July 3	4.3	1.9
		July 12	5.0	1.6
		July 18	4.9	--
		July 25	3.8	0.8
		Aug 3	4.6	1.1
		Aug 8	3.7	0.9

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
Kamaniskeg (cont'd)			
	Aug 22	5.3	0.8
	Sept 5	5.5	1.0
	Sept 24	5.2	2.2
	Oct 4	5.2	2.2
	Oct 31	5.2	2.5
	MEAN	4.55	1.64
	STANDARD DEVIATION	0.71	0.62
Kamaniskeg (west of Mask Island)			
	May 23	4.0	3.0
	May 28	3.7	2.0
	June 25	4.6	1.1
	June 11	3.1	2.3
	June 18	4.6	2.1
	June 25	4.9	1.7
	July 3	4.3	2.3
	July 12	4.7	1.4
	July 18	3.5	0.8
	July 25	4.3	1.1
	Aug 3	4.1	1.3
	Aug 8	3.2	1.2
	Aug 22	6.2	1.0
	Sept 5	5.5	1.1
	Sept 24	5.2	2.5
	Oct 4	5.2	2.4
	Oct 31	4.9	1.7
	MEAN	4.47	1.70
	STANDARD DEVIATION	0.83	0.64
51. Kennebec 1-A	May 21	2.3	3.6
	June 10	2.8	2.7
	July 8	3.3	0.4
	July 22	3.5	1.8
	Aug 26	3.9	2.7
	Sept 16	3.3	3.6
	Sept 30	3.5	1.4
	MEAN	3.23	2.31
	STANDARD DEVIATION	0.53	1.18

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
	Kennebec (cont'd)			
	1-B	May 21	2.3	3.9
		June 10	2.5	2.6
		July 8	3.1	0.4
		July 22	3.2	1.1
		Aug 26	3.9	4.6
		Sept 16	3.4	3.0
		Sept 30	3.8	1.3
		MEAN	3.17	2.41
		STANDARD DEVIATION	0.60	1.55
52.	Limerick	July 4	4.0	1.1
		July 11	4.3	1.3
		July 22	4.6	1.2
		Aug 8	4.6	1.5
		Aug 16	4.3	1.7
		Aug 27	4.3	--
		Sept 5	4.9	1.8
		Sept 11	4.6	1.4
		MEAN	4.45	1.43
		STANDARD DEVIATION	0.28	0.26
53.	Little Silver	July 2	4.8	3.1
		July 8	4.5	4.4
		July 25	4.6	1.9
		Aug 1	4.3	4.3
		Aug 13	3.0	3.6
		Sept 3	3.2	5.5
		Sept 16	3.4	9.2
		MEAN	3.97	4.57
		STANDARD DEVIATION	0.75	2.33
54.	Loughborough			
	East Basin	June 28	3.1	2.9
		July 10	3.8	3.4
		July 19	3.8	2.0
		Aug 3	2.9	4.3
		Aug 9	3.0	4.7
		Aug 16	3.0	2.5
		Aug 23	3.4	--
		Aug 29	3.4	4.6
		Sept 6	3.2	3.8
		Sept 13	2.9	5.7
		Sept 26	3.2	3.0

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
Loughborough East Basin (cont'd)			
	Oct 4	2.9	3.9
	Oct 15	3.4	3.2
	Oct 23	3.7	2.7
	MEAN	3.26	3.59
	STANDARD DEVIATION	0.33	1.04
West Basin			
	May 27	2.5	2.4
	June 6	4.6	1.2
	June 17	3.4	1.4
	July 2	4.3	2.5
	July 7	4.6	1.7
	July 15	4.0	1.4
	July 22	4.2	1.5
	July 26	3.2	2.9
	July 29	3.5	1.3
	Aug 9	3.7	1.8
	Aug 19	4.6	2.8
	Aug 26	4.1	2.7
	Sept 3	3.4	1.8
	Sept 16	5.0	2.2
	MEAN	3.94	1.97
	STANDARD DEVIATION	0.69	0.60
West Basin			
	Apr 28	3.2	
	May 5	3.2	
	May 12	3.4	
	May 19	3.5	
	May 26	3.7	
	June 2	4.0	
	June 8	4.0	
	June 16	4.0	
	June 23	4.0	
	June 30	4.3	
	July 4	4.7	
	July 13	4.7	
	July 21	4.1	
	July 26	4.0	
	Aug 4	4.3	
	Aug 18	4.3	
	Aug 25	4.1	
	Sept 2	4.1	
	Sept 15	3.8	

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
	West Basin (cont'd)			
		Sept 22	3.8	
		Sept 29	4.0	
		Oct 8	3.8	
		Oct 23	3.8	
		MEAN	4.08	
		STANDARD DEVIATION	0.75	
55.	Mackie	June 10	5.5	3.5
		June 17	5.8	4.1
		June 24	6.3	1.9
		July 3	6.4	2.7
		July 15	6.1	1.9
		July 22	6.7	2.2
		Aug 7	6.7	9.2
		Aug 13	7.2	1.6
		Aug 26	7.8	4.2
		Sept 4	6.8	1.3
		Sept 16	7.9	12.2
		Sept 23	7.9	9.4
		Oct 8	6.1	5.4
		MEAN	6.71	4.58
		STANDARD DEVIATION	0.79	3.51
56.	Mazinaw			
	Upper Basin	June 13	4.0	1.0
		June 27	4.3	1.1
		July 11	3.4	1.1
		Aug 9	5.5	1.4
		MEAN	4.30	1.15
		STANDARD DEVIATION	0.88	0.17
	Lower Mazinaw			
		July 23	6.0	1.1
		Aug 1	5.2	1.0
		Aug 7	5.0	1.6
		Aug 13	5.3	1.0
		Aug 27	5.3	1.2
		Sept 3	5.2	0.9
		Sept 7	5.3	1.9
		Sept 16	5.8	3.1
		Sept 23	6.0	1.7
		Sept 30	6.4	1.5
		Oct 7	5.2	1.5
		MEAN	5.52	1.50
		STANDARD DEVIATION	0.45	0.62

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
57. Mink	June 25	3.7	1.5
	July 23	4.8	0.5
	July 30	4.7	1.5
	Aug 20	4.2	1.8
	Aug 27	4.1	1.4
	Sept 4	4.0	1.8
	Sept 17	4.0	1.3
	MEAN	4.21	1.40
	STANDARD DEVIATION	0.40	0.44
58. Mississippi	Aug 14	2.1	9.2
	Aug 19	1.2	8.2
	Aug 28	1.8	9.1
	Sept 3	1.8	--
	Sept 10	1.5	6.7
	Sept 26	2.1	4.5
	MEAN	1.75	7.54
	STANDARD DEVIATION	0.35	1.97
59. Moira			
East Basin	Apr 30	2.5	--
	May 8	2.5	2.2
	June 16	2.3	2.7
	July 14	1.8	6.3
	Aug 17	0.9	29.5
	MEAN	2.00	10.18
	STANDARD DEVIATION	0.68	13.01
West Basin	June 17	2.3	4.4
	July 2	2.3	4.7
	July 8	2.0	5.0
	July 22	2.6	0.6
	July 29	1.8	3.6
	Aug 6	1.7	4.6
	Sept 6	1.4	13.4
	Sept 8	1.4	15.6
	MEAN	1.93	6.49
	STANDARD DEVIATION	0.45	5.17
60. Mosque			
#1	May 1	3.4	1.3
	May 21	5.2	1.5
	June 4	5.2	1.6
	July 2	5.5	1.5

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
	Mosque #1 (cont'd)	July 14	6.1	0.8
		July 29	5.8	1.9
		Aug 19	5.8	2.0
		Sept 3	6.4	1.4
		Sept 23	6.1	1.7
		MEAN	5.50	1.52
		STANDARD DEVIATION	0.89	0.35
	#2	May 1	3.4	1.7
		May 21	5.5	1.1
		June 4	5.2	1.0
		July 2	5.5	1.6
		July 14	6.1	0.8
		July 29	5.8	1.3
		Aug 19	5.8	1.8
		Sept 3	6.4	1.5
		Sept 23	6.4	1.5
		MEAN	5.57	1.37
		STANDARD DEVIATION	0.91	0.34
	#3	June 4	3.7	2.7
		July 2	4.6	3.7
		July 14	4.9	2.5
		July 29	4.6	3.4
		Aug 19	4.6	4.5
		Sept 3	5.2	2.6
		MEAN	4.60	3.23
		STANDARD DEVIATION	0.50	0.78
61.	Muskrat #1	June 10	2.5	3.0
		June 17	1.8	4.7
		June 25	2.2	7.8
		July 9	2.2	3.9
		July 16	2.4	2.4
		July 23	2.7	3.1
		July 30	2.7	6.6
		Aug 7	2.4	4.5
		Aug 13	2.1	21.5
		Aug 27	1.5	25.0
		Sept 5	2.7	6.2
		MEAN	2.29	8.06
		STANDARD DEVIATION	0.39	7.73

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
	Muskrat (cont'd)			
	#2	June 10	2.8	3.0
		June 17	2.2	4.7
		June 25	2.5	7.8
		July 9	2.5	3.8
		July 16	2.1	2.6
		July 23	3.0	3.0
		July 30	2.4	6.6
		Aug 7	2.7	4.4
		Aug 13	2.1	13.0
		Aug 27	2.4	13.5
		Sept 5	2.4	5.2
		MEAN	2.46	6.15
		STANDARD DEVIATION	0.28	3.85
62.	Norway	July 8	5.1	1.5
		July 15	5.3	1.5
		July 29	5.5	1.3
		Aug 3	4.4	1.3
		Aug 6	4.6	1.8
		Aug 12	5.0	1.7
		Aug 19	3.7	1.9
		Aug 26	5.0	1.7
		Sept 2	3.5	1.3
		Sept 16	5.0	3.8
		Sept 30	4.4	1.1
		MEAN	4.68	1.72
		STANDARD DEVIATION	0.64	0.73
63.	Olmstead	June 24	5.5	1.4
		July 8	5.5	0.9
		July 22	5.2	1.3
		Aug 5	6.4	1.9
		Sept 9	6.7	1.3
		Sept 17	7.3	0.9
		Oct 1	7.6	0.9
		MEAN	6.31	1.23
		STANDARD DEVIATION	0.94	0.37
64.	Opinicon	June 16	4.0	1.4
		July 2	3.4	2.2
		July 8	3.1	2.2
		July 22	3.0	1.5
		Aug 6	3.0	4.4
		Aug 13	2.7	5.3
		Aug 26	3.2	5.3

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
Opinicon (cont'd)			
	Sept 1	3.0	3.3
	July 3	4.0	2.3
	July 7	3.0	2.5
	July 14	4.4	--
	July 20	4.3	1.3
	July 28	3.0	1.9
	Aug 1	3.0	3.8
	Aug 12	2.7	12.4
	Aug 19	3.2	4.1
	Aug 26	3.5	3.3
	Sept 4	3.4	3.2
	Sept 11	2.7	4.7
	Sept 25	3.4	4.4
	MEAN	3.30	3.66
	STANDARD DEVIATION	0.51	2.48
65. Otter			
	June 9	3.7	2.1
	June 17	2.6	1.6
	June 24	4.3	1.5
	July 8	3.5	1.5
	July 22	3.4	2.0
	July 29	3.7	0.9
	Aug 5	2.7	1.1
	Aug 12	2.7	1.7
	Aug 26	2.7	3.5
	Aug 26	3.2	2.2
	Sept 3	2.7	1.8
	Sept 3	3.2	2.3
	Sept 9	3.0	3.2
	Sept 10	2.4	2.9
	Sept 17	3.0	2.8
	Sept 24	3.0	5.2
	MEAN	3.11	2.27
	STANDARD DEVIATION	0.51	1.07
66. Otty			
A	June 24	3.4	2.9
	July 2	4.0	2.1
	July 8	4.3	2.3
	July 15	4.0	1.5
	July 22	5.2	1.8
	July 30	4.6	2.1
	Aug 7	3.0	1.9

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
Otty (cont'd)	Aug 13	4.9	1.8
	Aug 20	4.9	2.8
	Aug 27	4.6	2.4
	Sept 3	4.3	2.0
	MEAN	4.29	2.15
	STANDARD DEVIATION	0.70	0.43
B	June 24	3.7	2.6
	July 8	4.0	2.2
	July 15	4.0	0.9
	July 22	5.2	2.3
	July 30	4.9	2.0
	Aug 7	4.3	2.1
	Aug 13	4.9	2.1
	Aug 20	4.6	2.2
	Aug 27	4.9	2.6
	Sept 3	4.3	1.7
	MEAN	4.44	2.08
	STANDARD DEVIATION	0.49	0.47
67. Palmerston	June 17	8.0	0.8
	June 24	10.2	0.9
	July 2	8.9	1.2
	July 8	9.2	1.4
	July 15	8.5	0.9
	July 22	8.5	0.9
	July 29	8.8	1.6
	Aug 6	8.8	2.4
	Aug 12	8.5	1.0
	Aug 19	7.9	3.4
	Aug 26	9.4	3.8
	Sept 3	7.9	0.8
	Sept 9	9.2	1.9
	Sept 16	8.5	1.9
	Sept 23	9.2	1.2
	MEAN	8.77	1.61
	STANDARD DEVIATION	0.62	0.94
68. Pike	Apr 22	3.4	2.1
	July 5	4.3	3.4
	July 13	4.9	3.3
	July 18	5.6	4.3
	July 23	4.3	4.3
	Aug 6	3.4	4.0
	Aug 13	3.4	5.0
	Aug 21	1.7	4.1
	Sept 3	2.7	5.2
	MEAN	3.74	3.97
	STANDARD DEVIATION	1.17	0.94

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
69. Potspoon	July 19	4.4	2.2
	Aug 7	4.0	2.2
	Aug 14	2.9	2.4
	Aug 23	3.0	2.7
	Aug 28	3.7	3.9
	Sept 7	3.7	3.7
	Sept 18	3.7	2.4
	Sept 26	4.0	--
	Oct 4	4.3	2.9
	Oct 10	3.5	2.2
	Oct 18	3.4	3.7
	Oct 25	3.0	1.7
	Nov 1	3.2	2.3
	Nov 7	2.7	4.5
	Nov 16	4.0	3.5
	MEAN	3.57	2.88
	STANDARD DEVIATION	0.52	0.83
70. Red Horse	June 3	2.8	4.5
	June 10	2.3	4.7
	June 16	3.0	2.1
	June 24	3.5	3.6
	June 30	3.6	2.3
	July 8	3.5	4.1
	July 15	3.0	5.3
	July 22	5.8	3.4
	July 29	3.8	3.8
	Aug 6	2.9	3.4
	Aug 11	3.0	3.5
	Aug 19	3.4	4.5
	Aug 28	3.2	5.0
	Sept 6	3.4	4.6
	Sept 16	3.0	8.5
	Sept 22	2.9	5.4
	Sept 30	3.7	4.3
	Oct 8	4.0	5.3
	MEAN	3.38	4.35
	STANDARD DEVIATION	0.73	1.40
71. Robertson	July 17	6.7	0.7
	July 14	7.5	6.8
	Aug 3	6.7	1.1
	Aug 12	6.9	1.9
	Aug 20	6.7	1.5
	MEAN	6.90	2.40
	STANDARD DEVIATION	0.35	2.50

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
72. Round	July 8	4.6	1.2
	July 8	4.6	1.1
	July 16	3.7	1.1
	July 16	5.5	0.9
	July 17	6.7	0.7
	July 24	7.5	6.8
	Aug 8	3.2	2.5
	Aug 28	3.5	1.2
	Sept 4	3.5	2.0
	Sept 21	3.4	3.6
	MEAN	4.51	1.99
	STANDARD DEVIATION	1.47	1.82
73. St. Peter	Aug 22	4.4	2.1
	Aug 30	3.0	2.9
	Sept 5	3.7	1.6
	Sept 11	3.2	1.8
	Sept 18	3.4	2.0
	Sept 26	3.5	1.6
	MEAN	3.53	2.00
	STANDARD DEVIATION	0.49	0.49
74. Salmon Trout	May 21	6.0	1.3
	June 3	3.4	6.2
	June 17	3.1	3.9
	July 15	3.0	5.4
	July 22	3.5	6.1
	Aug 12	3.4	6.2
	Aug 26	3.0	9.2
	Sept 9	2.9	--
	Sept 23	2.4	6.8
	Sept 30	2.4	16.0
	Oct 8	2.7	13.2
	Oct 14	2.6	7.4
	Oct 21	3.0	7.4
	MEAN	3.18	7.43
	STANDARD DEVIATION	0.92	3.92
75. Sharbot Cranberry Bay			
	May 28	2.5	2.1
	June 13	3.1	1.9
	June 24	2.8	2.2
	July 10	3.1	2.1
	July 18	2.9	1.4

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
75. Sharbot			
Cranberry Bay (cont'd)			
	July 24	3.4	1.1
	July 31	2.3	1.0
	Aug 7	3.0	1.5
	Aug 16	2.7	2.7
	Aug 22	3.0	2.2
	Sept 17	3.4	2.7
	Sept 25	3.0	2.7
	MEAN	2.93	1.97
	STANDARD DEVIATION	0.33	0.60
Hawley Bay	May 28	2.5	2.7
	June 13	2.8	1.1
	June 24	3.1	1.8
	July 10	3.1	2.0
	July 18	3.4	1.8
	July 24	3.4	0.7
	July 31	2.9	1.3
	Aug 7	3.0	1.7
	Aug 16	2.9	3.3
	Aug 22	3.4	2.3
	Sept 17	3.7	2.9
	Sept 25	3.4	2.9
	MEAN	3.13	2.02
	STANDARD DEVIATION	0.34	0.77
McCrimmon Bay			
	May 28	3.1	2.4
	June 13	3.1	2.5
	June 24	3.1	1.8
	July 10	3.1	1.7
	July 18	3.5	1.4
	July 24	3.7	1.0
	July 31	3.1	1.3
	Aug 7	3.1	1.6
	Aug 16	3.1	2.6
	Aug 22	3.7	2.2
	Sept 17	3.7	3.0
	Sept 25	3.7	2.8
	MEAN	3.33	2.03
	STANDARD DEVIATION	0.29	0.65
West Basin	May 30	3.7	3.1
	June 13	4.0	2.7
	June 27	4.6	1.4

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
	West Basin	July 11	4.9	1.5
		July 25	4.3	1.0
		Aug 9	4.6	1.8
		MEAN	4.35	1.92
		STANDARD DEVIATION	0.44	0.81
76.	Silver			
	East	June 10	3.6	2.6
		June 15	3.4	1.3
		June 21	4.0	2.5
		July 2	5.2	1.5
		July 8	4.9	1.7
		July 19	4.6	1.5
		July 25	5.0	2.4
		July 31	4.3	1.9
		Aug 12	3.4	2.5
		Aug 27	4.1	2.2
		Sept 4	3.7	1.4
		Sept 11	3.5	2.1
		Sept 16	4.1	2.3
		Sept 26	4.0	1.6
		Oct 7	4.0	2.4
		MEAN	4.12	1.99
		STANDARD DEVIATION	0.58	0.46
	West	June 10	3.4	2.1
		June 15	3.1	1.0
		June 21	4.5	2.3
		July 2	5.2	2.2
		July 8	5.2	2.8
		July 19	4.6	2.2
		July 25	4.7	2.1
		July 31	4.9	2.4
		Aug 12	3.4	1.9
		Aug 27	3.8	2.1
		Sept 4	4.1	1.4
		Sept 11	3.8	1.9
		Sept 16	3.8	1.2
		Sept 26	4.1	1.5
		Oct 7	4.3	2.3
		MEAN	4.19	1.96
		STANDARD DEVIATION	0.65	0.49
	Mid Lake	July 31	4.6	1.3
		Aug 12	3.2	1.9
		Aug 27	4.0	1.3

LAKE		DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
	Mid Lake (cont'd)			
		Sept 4	4.3	1.2
		Sept 11	3.7	5.1
		Sept 16	4.0	2.1
		Sept 16	4.0	1.7
		Oct 7	4.1	2.1
		MEAN	3.99	2.09
		STANDARD DEVIATION	0.41	1.27
77.	Spectacle			
	North Basin	July 2	2.3	3.5
		July 22	2.3	3.0
		MEAN	2.3	3.25
	South Basin	July 2	4.6	2.3
78.	Steenburg	July 15	4.3	0.3
		July 22	4.6	0.5
		July 29	4.9	0.8
		Aug 4	4.9	2.0
		Aug 20	4.0	1.9
		Sept 2	4.4	4.6
		Sept 16	5.2	4.6
		Oct 8	3.7	2.1
		Oct 14	4.3	2.3
		MEAN	4.48	2.12
		STANDARD DEVIATION	0.47	1.58
79.	Sydenham	June 17	3.1	2.7
		June 24	3.8	3.1
		July 16	4.0	1.6
		July 29	3.0	2.0
		Aug 12	2.6	3.1
		Aug 19	4.4	--
		Aug 26	3.2	3.1
		Sept 3	2.9	2.6
		Sept 9	4.4	5.2
		Sept 16	4.3	3.6
		Sept 23	4.1	3.5
		MEAN	3.62	2.95
		STANDARD DEVIATION	0.67	0.98
80.	Temperance	July 8	2.5	6.9
		July 15	2.7	1.7
		July 22	2.3	0.9

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
Temperance (cont'd)			
	July 29	3.0	1.7
	Aug 5	2.5	1.6
	Aug 26	2.7	5.0
	Sept 3	2.6	3.6
	MEAN	2.61	3.06
	STANDARD DEVIATION	0.22	2.21
81. Thirty Island			
	June 17	4.6	1.8
	July 9	5.2	1.9
	July 14	5.8	0.8
	July 17	4.6	--
	July 29	4.7	1.9
	Aug 5	4.0	1.0
	Aug 13	4.1	2.2
	Aug 17	4.0	1.0
	Sept 9	4.3	3.0
	MEAN	4.59	1.70
	STANDARD DEVIATION	0.60	0.74
82. Trout (Stubb's)			
	Aug 27	7.9	1.8
	Sept 4	5.8	--
	MEAN	6.85	1.8
83. Troy	Apr 15	2.8	--
	Apr 29	1.8	7.4
	May 6	2.2	7.2
	May 13	2.9	4.8
	May 27	2.8	3.5
	June 3	2.8	3.5
	June 10	2.5	3.4
	June 17	2.2	5.4
	June 25	2.3	7.2
	July 2	1.8	6.2
	July 8	1.6	7.9
	July 15	1.8	6.6
	July 22	1.8	8.0
	July 29	1.5	6.2
	Aug 12	1.2	13.8
	Aug 26	1.4	16.9
	Sept 16	1.2	17.2
	Sept 23	1.5	11.4
	Oct 21	1.8	6.7
	MEAN	1.99	7.96
	STANDARD DEVIATION	0.56	4.20

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
84. Verona (Rock)			
	July 8	2.9	8.1
	July 22	3.2	9.0
	Aug 13	2.1	7.7
	Sept 3	2.4	6.2
	Sept 9	2.1	5.5
	Sept 16	1.8	4.6
	Sept 23	1.8	4.4
	MEAN	2.33	6.50
	STANDARD DEVIATION	0.54	1.80
85. Weslemkoon	May 20	4.0	1.1
	June 3	4.0	1.3
	June 18	2.8	2.7
	June 24	3.1	2.9
	July 15	3.7	1.0
	MEAN	3.51	1.80
	STANDARD DEVIATION	0.54	0.92
86. White			
#1	May 6	3.8	3.8
	May 21	3.5	3.1
	June 3	4.5	7.5
	June 17	3.1	7.0
	June 24	2.5	4.1
	July 2	2.9	0.8
	July 8	2.9	3.4
	July 14	3.2	1.0
	July 22	2.9	1.8
	July 29	2.7	2.1
	July 29	2.6	1.0
	Aug 6	2.3	3.4
	Sept 3	2.6	1.9
	MEAN	3.04	3.15
	STANDARD DEVIATION	0.60	2.13
#2	May 6	3.5	2.0
	May 21	4.2	3.9
	June 3	4.5	3.4
	June 17	2.8	6.0
	June 24	3.8	5.1
	July 8	2.6	0.4
	July 8	2.6	4.2
	July 14	3.2	1.7
	July 22	2.9	1.0
	July 27	2.9	0.9
	Aug 6	2.6	1.9
	Sept 3	2.9	2.3
	MEAN	3.04	2.73
	STANDARD DEVIATION	0.93	1.77

LAKE	DATE	SECCHI DISC (m)	CHLOROPHYLL a (ug/l)
87. White	June 10	4.9	1.2
	June 24	7.7	2.3
	Aug 7	3.0	0.9
	Sept 3	3.7	1.5
	MEAN	4.83	1.48
	STANDARD DEVIATION	2.07	0.60
88. Whitefish	May 21	3.1	1.5
	May 27	3.7	1.4
	June 3	3.2	2.0
	June 10	3.7	2.3
	June 17	3.1	2.7
	July 2	3.2	2.6
	July 8	2.8	3.3
	July 17	3.0	2.0
	July 29	2.7	2.1
	Aug 3	2.4	3.2
	Aug 9	2.4	3.6
	Sept 9	2.4	3.6
	Sept 16	2.7	4.0
	Oct 8	3.0	3.3
	MEAN	2.96	2.58
	STANDARD DEVIATION	0.43	0.80

DATE	ISSUED TO